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PATENT APPLICATION

ATTORNEY DOCKET NO. 10011959-5

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Chien-Hua Chen

Confirmation No.: 1367

Application No.: 10/666,609

Examiner: OEN, William L.

Filing Date: Sept. 18, 2003

Group Art Unit: 2855

Title: A Pressure Sensor and Method of Making the Same Having Membranes Forming a Capacitor

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on June 3, 2005.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $500.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

( )	one month	$120.00
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( ) The extension fee has already been filled in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account **08-2025** the sum of $500.00. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Signature: Rebecca R. Schow

Respectfully submitted,

Chien-Hua Chen

By Steven L. Nichols

Steven L. Nichols

Attorney/Agent for Applicant(s)

Reg. No. 40,326

Date: August 3, 2005

Telephone No.: (801) 572-8066

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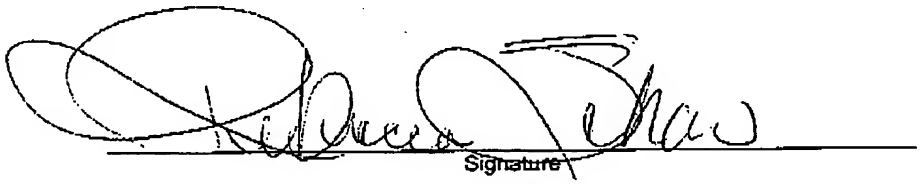

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In the Continuation of
the U.S. Patent Application of

Chien-Hua Chen

Serial No.: 10/666,609

Filed: September 18, 2003

For: A Pressure Sensor and Method of Making the Same Having Membranes Forming a Capacitor (as amended)

Group Art Unit: 2855

Examiner: OEN, William L.

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an Appeal Brief under Rule 41.37 appealing the final decision of the Primary Examiner dated March 8, 2005. Each of the topics required by Rule 41.37 is presented herewith and is labeled appropriately.

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I. Real Party in Interest

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 20555 S.H. 249 Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

II. Related Appeals and Interferences

There are no appeals or interferences related to the present application of which the Appellants are aware.

III. Status of Claims

Claims 8-45, 50-52 and 55-56 were withdrawn under a Restriction Requirement and eventually cancelled from the application. Claims 1-7, 46-49, 53, 54 and 57-63 are currently pending in the application and stand finally rejected. Appellant appeals from the final rejection of claims 1-7, 46-49, 53, 54 and 57-63, which claims are presented in the Appendix.

IV. Status of Amendments

Following the final Office Action of March 8, 2005, Appellant filed a single after-final response on May 4, 2005. However, that response made no amendments to the application. Therefore, it's entry into the record has no impact on the pending claims as presented in the Appendix.

V. Summary of Claimed Subject Matter

Conventional pressure sensors are used in wide variety of applications to monitor or control pressure in devices or systems where maintaining a particular pressure is important. However, conventional pressure sensors are relatively large and are not easily integrated with other devices, particularly, microelectronic devices. (Appellant's specification, paragraphs 0002-0003).

Accordingly, the present application provides for a novel pressure sensor design that is more easily fabricated and incorporated in microelectronic and other devices. This pressure sensor includes a first membrane that flexes in response to pressure, a reference cavity covered by the first membrane, the reference cavity containing a vacuum and a second membrane adjacent to the first membrane, but not in contact with or exposed to the vacuum. The first and second membranes form a capacitor having a capacitance that varies in accordance with the flexing of the first membrane and the pressure. (Appellant's specification, paragraph 0014).

As shown in Fig. 1a, a pressure sensor (100), according to principles of the present application, includes a thin silicon membrane (101). The thickness of the membrane (101) is such that the membrane (101) is responsive to, and will flex in proportion with, a pressure (110) applied to the sensor (100). Behind the thin membrane (101) is a reference cavity (103). The sealed reference cavity (103) contains a vacuum. (Appellant's specification, paragraph 0021).

A second silicon membrane (102), which is preferably thicker and less flexible that the thin membrane (101), is formed adjacent to the thin membrane (101) *outside the reference cavity (103)*. The two membranes (101, 102) and the walls defining the reference cavity

(103) can be supported between an upper substrate (104) and a lower substrate (105). (Appellant's specification, paragraph 0022).

Together, the thin membrane (101) and the second membrane (102) form a capacitor with a specific capacitance that can be measured through, for example, the electrical connections (107). As various amounts of pressure (110) are applied to the sensor (100), the thin membrane (101) will flex in proportion to the amount of pressure applied. As the thin membrane (101) flexes, the space between the thin membrane (101) and the second membrane (102) will vary. The variation in the space between the thin membrane (101) and the second membrane (102) will correspond to the amount of pressure (110) applied to the sensor (100). The variation in the space between the thin membrane (101) and the second membrane (102) will also vary the capacitance of the capacitor formed by the two membranes (101, 102). The change in capacitance ΔC will be directly related to the amount of pressure (101) applied to the sensor (100). Consequently, an indication of the pressure (110) applied can be output by the circuit, including connections (107), that monitors the capacitance between the thin membrane (101) and the second membrane (102). A numeric reading of the pressure can be calculated from the change in capacitance, if desired. (Appellant's specification, paragraphs 0025-0027).

Figs. 9a and 9b illustrate further possible features of the claimed pressure sensor in which one of the membranes of the pressure sensor is formed with a curvature so as to be concave or convex. In Fig. 9a, the thin membrane (101a) is curved with respect to the second membrane (102) and curves toward the second membrane (102). In Fig. 9b, the thin membrane (101b) is again curved with respect to the second membrane (102), but is curved away from the second membrane (102). (Appellant's specification, paragraph 0055).

The manner in which the membranes (101, 102) are formed makes it possible for the membranes to be formed with a curvature. As described in Appellant's application, the membranes (101, 102) may be formed by etching a silicon or other substrate. Consequently, the etching can be conducted so as to impart a curvature to one or the other of the two membranes (101, 102). (Appellant's specification, paragraph 0056).

When one of the membranes (101, 102) has a convex or concave shape, the pressure sensor (100) may be sensitive to a broader range of pressures. Additionally, when one of the membranes (101, 102) has a convex or concave shape, the pressure sensor (100) may be more sensitive, i.e., register smaller changes in pressure than would otherwise be detectable. (Appellant's specification, paragraph 0057).

VI. Grounds of Rejection to be Reviewed on Appeal

The final Office Action rejected claims 1-7, 46-49, 53, 54 and 57-63 as being unpatentable under 35 U.S.C. § 103(a) over the combined teachings of U.S. Patent No. 4,689,999 to Shkedi ("Shkedi") and U.S. Patent No. 5,381,299 to Provenzano et al. ("Provenzano"). This is the sole issue raised in the final Office Action and the grounds of rejection to be reviewed on this appeal.

VII. Argument

Claim 57:

Claim 57 recites:

> A pressure sensor comprising:
> a first membrane that flexes in response to pressure;
> a reference cavity covered by said first membrane, said reference cavity containing a vacuum; and
> a second membrane adjacent to said first membrane;

wherein said reference cavity and said second membrane are disposed on opposite sides of said first membrane, said first and second membranes forming a capacitor having a capacitance that varies in accordance with the flexing of said first membrane and said pressure.

The final Office Action does not indicate why or how the teachings of Shkedi and Provenzano are to be combined to approximate the subject matter of claim 57. Rather, the final Action appears to allege that Shkedi taken alone teaches all the features of claim 57. According to the final Action, "Shkedi explicitly teaches . . . a first membrane 14 that flexes in response to pressure, a reference cavity covered by the first membrane, the reference cavity 132 containing a vacuum (see, e.g., col. 7, lines 42-50) and a second membrane (16 and/or 18) adjacent to said first membrane wherein the reference cavity and the second membrane are disposed on opposite sides of the first membrane 14, the first and second membranes form a capacitor." (Action 3/8/05, p. 2).

This, however, is demonstrably incorrect given a cursory review of Figs. 1 and 2 of Shkedi. Shkedi actually fails to teach or suggest the claimed sensor with a reference cavity and second membrane disposed on *opposite* sides of a first membrane that flexes in response to pressure. The Office Action identifies the claimed first membrane with element (14) of Shkedi, the reference cavity with element (132) and the second membrane with element (16 and/or 18). However, reference number (132) does not exist in the Shkedi reference. Appellant had pointed this out, but the Office did not bother to clarify the rejection in the Advisory Action of May 16, 2005.

Consequently, Appellant must assume that the Action is referring to the space immediately below the first diaphragm (14) as the "reference cavity." That being the case, any review of the figures of Shkedi will show that the reference cavity and the second

membrane (16 and/or 18) are on the *same* side of the first membrane (14) and are *not* on opposite sides of the first membrane as claimed.

Therefore, Shkedi not only fails to teach or suggest the claimed invention, but actually teaches away from claim 57 by showing the reference cavity and the second membrane (16 and/or 18) on the *same* side of the first membrane (14). Presumably, this deficiency may somehow by remedied by Provenzano. However, the final Office Action does not indicate how or why the teachings of Provenzano are to be combined with Shkedi in this regard so as to overcome the contrary teachings of Shkedi that the reference cavity and second membrane are on the same side of the first membrane. Consequently, the final Office Action fails to make out a *prima facie* case of unpatentability as to claim 57.

Moreover, Provenzano does not appear to teach or suggest a reference cavity containing a vacuum and second membrane on *opposite* sides of a first membrane as claimed. Thus, neither of the cited prior art references teach or suggest the features of claim 57. "To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). Because the neither Shkedi nor Provenzano teach or suggest the claimed reference cavity containing a vacuum and a second membrane that are on opposite sides of a first membrane, the rejection of claim 57 should not be sustained.

Claims 1-7 and 46-49:

Turning to claim 1, claim 1 recites:

> A pressure sensor comprising:
> a first membrane that flexes in response to pressure;

a reference cavity covered by said first membrane, said reference cavity containing a vacuum; and

a second membrane adjacent to said first membrane;

wherein said second membrane is not in contact with said vacuum; and

wherein said first and second membranes form a capacitor having a capacitance that varies in accordance with the flexing of said first membrane and said pressure.

(emphasis added).

Similarly, claim 46 recites:

A pressure sensor comprising:

a first means for flexing in response to pressure;

a reference cavity covered by said first means, said reference cavity containing a vacuum;

a second means for forming a capacitor with said first means, said capacitor having a capacitance that varies in accordance with the flexing of said first means and said pressure; and

means for measuring said capacitance;

wherein said second means is adjacent to said first means and not exposed to said vacuum within said reference cavity.

(emphasis added).

In contrast, the combination of Shkedi and Provenzano fails to teach or suggest a second membrane or means that is not in contact with, or exposed to, a vacuum. The final Office Action implicitly admits that the combination fails to teach this feature of the claimed invention. According to the final Office Action, "it would have been obvious to form the second membrane of Shkedi to NOT be in contact with the vacuum, if desired." (Action of 3/8/05, p. 4) (emphasis in the original). This is a mere conclusion that has *no* support in the prior art actually cited.

As shown in Fig. 1 of Shkedi, all the space between the various diaphragms (12, 16, 18) is interconnected (*See* passageways 30 and 36). Consequently, when the sensor is used and the space is evacuated, as described in col. 5, lines 49-50, each of the diaphragms is in contact with the vacuum. Consequently, Shekdi does not teach, but rather teaches away from, the claimed subject matter. A reference must be considered for all it teaches, including

disclosures that teach away from the invention as well as disclosures that point toward the invention. *Ashland Oil, Inc. v. Delta Resins & Refractories, Inc.*, 776 F.2d 281, 227 U.S.P.Q. 657 (Fed. Cir. 1985).

Provenzano is apparently cited merely for the teaching of a curved membrane, which is irrelevant to the recitations of claims 1 and 46. Provenzano also does not teach or suggest a second membrane that is not in contact with a vacuum as claimed.

Consequently, the cited prior art fails to teach or suggest all the features of claims 1 and 46. In fact, the final Office Action did not even discuss the salient features of claims 1 and 46 other than to state, without support, that the features of the claims, though not taught by any prior art of record, are, nonetheless, "obvious"

Consequently, the final Office Action has failed to make out a *prima facie* case of unpatentability with respect to these claims. "To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). Because the combination of Shkedi and Provenzano fails to teach or suggest the claimed second membrane that is not in contact with a vacuum, the rejection of claims 1-7 and 46-49 should not be sustained.

Claims 53 and 54:

Claim 53 recites:

> A pressure sensor comprising:
> a first membrane that flexes in response to pressure;
> a reference cavity covered by said first membrane, said reference cavity containing a vacuum; and
> a second membrane adjacent to said first membrane, said first and second membranes forming a capacitor having a capacitance that varies in accordance with the flexing of said first membrane and said pressure;

wherein one of said membranes is formed with a curvature with respect to the other said membrane.

(emphasis added).

In contrast, the combination of Shkedi and Provenzano fails to teach or suggest a membrane formed with a curvature with respect to another membrane. As noted above, the final Office Action cites Provenzano as teaching a membrane formed with a curvature. (Action of 3/8/05, p. 3). However, as Appellant demonstrated previously, this is a misreading of Provenzano which should *not* have been reiterated in the final Office Action.

Fig. 3 of Provenzano *appears* to show a curved membrane (104). However, the membrane (104) is *not* formed with a curvature as claimed, but is merely show in Fig. 3 as being deflected under the application of pressure. (Provenzano, col. 3, lines 51-53). Fig. 2 shows the same membrane (104) having no curvature when pressure is not being applied. Consequently, no reference of record actually teaches or suggest a membrane formed with a curvature as claimed. Thus, the combination of Shkedi and Provenzano fails to teach or suggest a membrane *formed with a curvature* with respect to another membrane, as claimed.

The final Office Action appears to concede that Shkedi and Provenzano fail to teach the claimed membrane having a curvature with respect to another membrane. In response to Appellant's explanation of what Provenzano actually teaches, the final Office Action now merely argues that "all diaphragms and membranes are formed with some inherent curvature (even if the curvature possesses a very large radius of curvature)." (Action of 3/8/05, p. 4).

This statement is unsupported by the art of record, but, even if credited as true, does not apply to the recitations of claim 53. If all membranes have an inherent curvature, as alleged by the final Office Action, then both the first and second claimed membranes would have this "inherent" curvature and, therefore, would *not* have a curvature *with respect to each other*. Thus, the cited prior art does not teach or suggest the claimed first and second

membranes of a pressure sensor where "one of said membranes is formed with a curvature with *respect to the other said membrane*."

"To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). For at least this reason, the rejection of claims 53 and 54 should not be sustained.

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the Final Rejection of March 8, 2004 is respectfully requested.

Respectfully submitted,

DATE: August 3, 2005

Steven L. Nichols
Registration No. 40,326

Steven L. Nichols, Esq.
Managing Partner, Utah Office
Rader Fishman & Grauer PLLC
River Park Corporate Center One
10653 S. River Front Parkway, Suite 150
South Jordan, Utah 84095
(801) 572-8066
(801) 572-7666 (fax)

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Rebecca R. Schow

VIII. CLAIMS APPENDIX

1. (previously presented) A pressure sensor comprising:

a first membrane that flexes in response to pressure;

a reference cavity covered by said first membrane, said reference cavity containing a vacuum; and

a second membrane adjacent to said first membrane;

wherein said second membrane is not in contact with said vacuum; and

wherein said first and second membranes form a capacitor having a capacitance that varies in accordance with the flexing of said first membrane and said pressure.

2. (original) The pressure sensor of claim 1, wherein said first and second membranes are made of silicon.

3. (original) The pressure sensor of claim 1, further comprising:

an upper substrate; and

a lower substrate;

wherein said first and second membranes are supported between and bonded to said upper and lower substrates.

4. (original) The pressure sensor of claim 3, further comprising electrical connections patterned on one of said substrates and in electrical connection with said first and second membranes for measuring said capacitance.

5. (original) The pressure sensor of claim 1, wherein said first and second membranes are formed in a silicon substrate.

6. (original) The pressure sensor of claim 5, further comprising a polysilicon anchor on both edges of said first membrane securing said first membrane in said silicon substrate.

7. (original) The pressure sensor of claim 1, wherein said first or second membrane has a curvature.

8-45. (cancelled)

46. (previously presented) A pressure sensor comprising:

a first means for flexing in response to pressure;

a reference cavity covered by said first means, said reference cavity containing a vacuum;

a second means for forming a capacitor with said first means, said capacitor having a capacitance that varies in accordance with the flexing of said first means and said pressure; and

means for measuring said capacitance;

wherein said second means is adjacent to said first means and not exposed to said vacuum within said reference cavity.

47. (original) The pressure sensor of claim 46, wherein said first and second means each comprise a membrane made of silicon.

48. (original) The pressure sensor of claim 46, wherein said means for measuring said capacitance comprise electrical connections patterned on a substrate supporting said first and second means.

49. (original) The pressure sensor of claim 46, wherein either said first or second means has a curvature.

50-52. (cancelled)

53. (previously presented) A pressure sensor comprising:

a first membrane that flexes in response to pressure;

a reference cavity covered by said first membrane, said reference cavity containing a vacuum; and

a second membrane adjacent to said first membrane, said first and second membranes forming a capacitor having a capacitance that varies in accordance with the flexing of said first membrane and said pressure;

wherein one of said membranes is formed with a curvature with respect to the other said membrane.

54. (original) The pressure sensor of claim 53, wherein said first and second membranes are made of silicon.

55-56. (cancelled)

57. (previously presented) A pressure sensor comprising:

a first membrane that flexes in response to pressure;

a reference cavity covered by said first membrane, said reference cavity containing a vacuum; and

a second membrane adjacent to said first membrane;

wherein said reference cavity and said second membrane are disposed on opposite sides of said first membrane, said first and second membranes forming a capacitor having a capacitance that varies in accordance with the flexing of said first membrane and said pressure.

58. (previously presented) The pressure sensor of claim 57, wherein said first and second membranes are made of silicon.

59. (previously presented) The pressure sensor of claim 57, further comprising:

an upper substrate; and

a lower substrate;

wherein said first and second membranes are supported between and bonded to said upper and lower substrates.

60. (previously presented) The pressure sensor of claim 59, further comprising electrical connections patterned on one of said substrates and in electrical connection with said first and second membranes for measuring said capacitance.

61. (previously presented) The pressure sensor of claim 57, wherein said first and second membranes are formed in a silicon substrate.

62. (previously presented) The pressure sensor of claim 61, further comprising a polysilicon anchor on both edges of said first membrane securing said first membrane in said silicon substrate.

63. (previously presented) The pressure sensor of claim 57, wherein said first or second membrane is formed with a curvature.

IX. Evidence Appendix

None

X. Related Proceedings Appendix

None

XI. Certificate of Service

None